
i2002 Internet Telephone

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Reference list

The following are the references for this section:

- *IP Line: Description, Installation and Operation* (553-3001-204)
- *Software Input/Output: Administration* (553-3001-311)
- *i2002 Internet Telephone User Guide*

Overview

This section describes the i2002 Internet Telephone, and provides procedures that explain how to install and maintain the i2002 Internet Telephone.

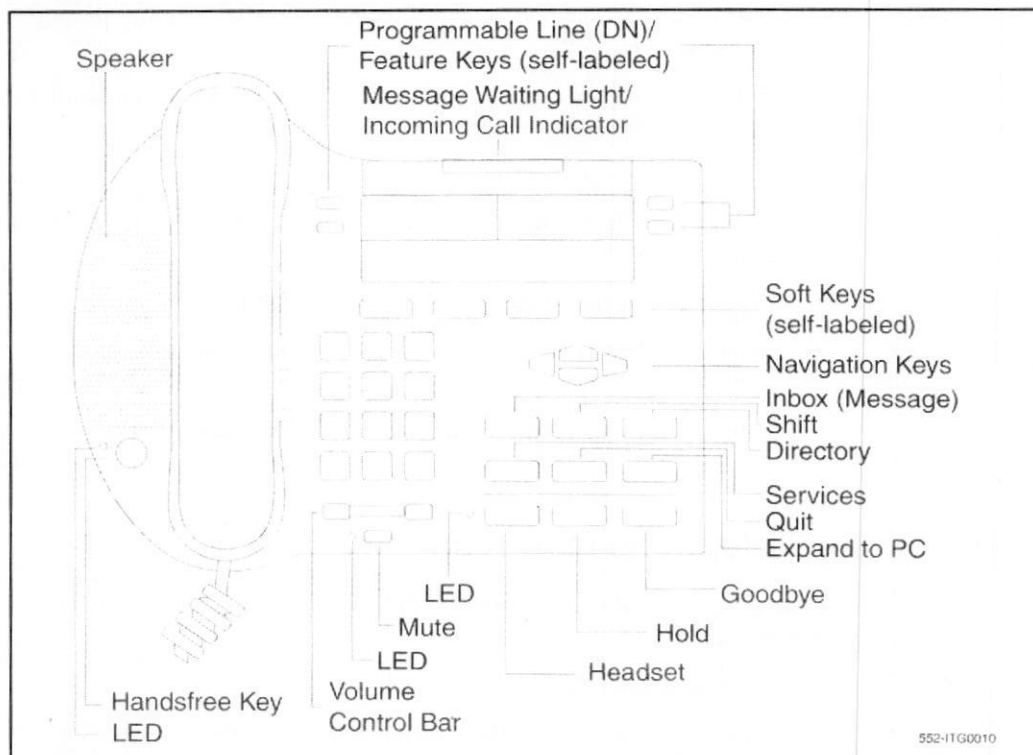
This section contains the following procedures:

- Procedure 1, "Pre-installation checklist" on page 20.
- Procedure 2, "Installing an i2002 Internet Telephone for the first time" on page 24.
- Procedure 3, "Installing an i2002 Internet Telephone for the first time using DHCP" on page 29.
- Procedure 4, "Changing the TN of an existing i2002 Internet Telephone" on page 32.
- Procedure 5, "Replacing an i2002 Internet Telephone" on page 33.
- Procedure 6, "Removing an i2002 Internet Telephone from service" on page 34.

i2002 Internet Telephone description

The i2002 Internet Telephone brings voice and data to the desktop environment and connects directly to the LAN through the Ethernet connection. Similar in appearance and functionality to the i2004 Internet Telephone, the i2002 Internet Telephone has a smaller display and fewer feature keys. See Figure 1: "i2002 Internet Telephone components" on page 13.

Figure 1
i2002 Internet Telephone components



New supported features

The i2002 Internet Telephone supports the following new features that are also supported on the i2004 Internet Telephone:

- 802.1Q VLAN and Layer 2 priority bit support, an industry standard for managing bandwidth usage.
- NAT support improvement.
- Ability to change the feature key labels (with Succession CSE 1000 R2.0 systems only).
- Corporate Directory (with Succession CSE 1000 R2.0 systems only).
- Support for Virtual office (with Succession CSE 1000 R2.0 systems only).
- Support for Branch Office (with Succession CSE 1000 R2.0 systems only).

i2002 Internet Telephone features

In addition to the above features, the i2002 Internet Telephone supports the following features:

- Message Waiting/Incoming Call indicator
- Four programmable line (DN)/feature keys (self-labeled). One must be the prime DN key.
- Four soft keys (self-labeled) that provide access to multiple features.
- Six icon-labeled fixed feature keys
 - Headset key (and indicator)
 - Directory key
 - Inbox (Message) key
 - Shift key
 - Services key
 - Expand to PC key
- One-line Soft key label display area

- One-line information display area
- Navigation keys (up and down, left and right)
- Goodbye key
- Hold Key
- Handsfree key with indicator
- Mute key and indicator
- Quit key
- Volume control bar
- Integrated switch to support sharing LAN access with a PC or other data device

Features not currently supported

The following features are not supported on the i2004 Internet Telephone:

- Personal Directory
- Call Log and Redial List
- Expansion Modules
- Support of accessory modules
- Live Dial pad
- Group Listening
- Set-to-Set messaging
- Context-sensitive soft keys

The three-port switch that is internal to the i2002 Internet Telephone and internal/external to the i2004 Internet Telephone, is an unmanaged switch. The 802.1Q header is not interpreted by it; rather, it passes the packets (unmodified). The three-port switch provides priority based on the port. The telephone "port" traffic gets priority over the Ethernet.

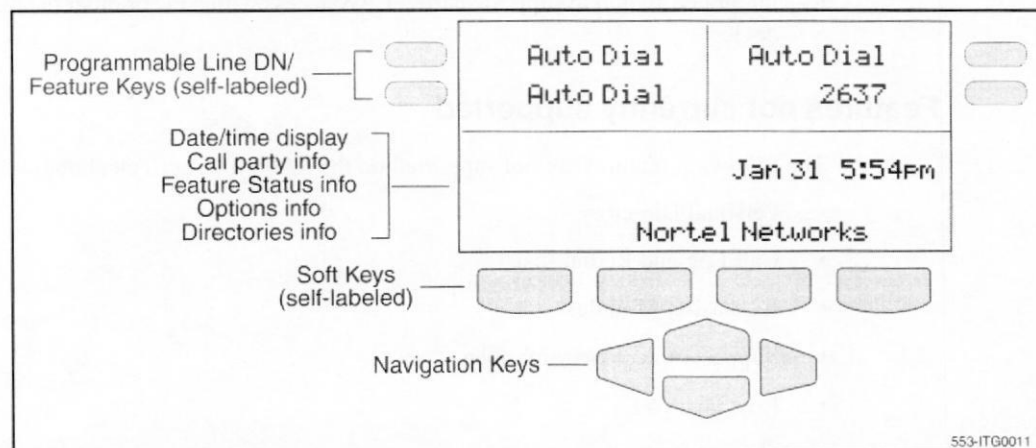
i2002 Internet Telephone display characteristics

An i2002 Internet Telephone has three major display areas:

- Programmable Line (DN)/Feature Key Label
- Soft Key Label
- Information Line

These three display areas are illustrated in Figure 2.

Figure 2
i2002 Internet Telephone display areas



Programmable Line (DN)/Feature Key Label display

The feature key label area displays a ten-character string for each of the four feature keys. Each feature key includes the key label and an icon. The icon state can be on, off, or flashing. Key labels are left-aligned for keys on the left side of the screen, and right-aligned for keys on the right side of the screen.

Note: If a label is longer than ten characters, the last ten characters are displayed and the excess characters are deleted from the beginning of the string.

Soft Key Label display

The soft key label display area displays a maximum six-character string. Each soft key includes the soft key label and an icon. When a soft key is in use, a flashing icon displays at the beginning of the soft key label, and the label shifts one character to the right. If a feature is enabled (for example, call forward is enabled), the icon state turns to on. It remains in the on state until the feature key is pressed again. This cancels the enabled feature and turns the icon off, returning the soft key label to its original string.

Information Line display

An i2002 Internet Telephone has a one-line information display area. The one-line area displays information as follows:

- Caller Number
- Caller Name
- Feature prompt strings
- User-entered digits
- Date and time information (if the telephone is in idle state)

The information area displays different information, according to the telephone's call processing state, active features, and activated features.

i2002 Internet Telephone key number assignments

The i2002 Internet Telephone has four soft-labeled, pre-defined keys that are used to provide up to 10 features. Because they are pre-defined, the user cannot change the key number assignment.

The Message key is numbered 16, as it is on the i2004 Internet Telephone. Key numbers 17-31 are the four soft key labels below the display area. See Figure 1 on page 13.

Key numbers 17 - 31 support the features A03, A06, CFW, CHG, CPN, PRK, PRS, RGA, RPN, SCC, SCU, SSC, SSU and TRN, as listed in Table 1 on page 18.

Key number assignments at the Call Server are aligned with that of the i2004 Internet Telephone. The mappings between i2002 soft key numbers and PBX CPU key numbers are the same as on the i2004 Internet Telephone.

i2002 Internet Telephone dedicated keys

Table 1 describes the telephone assignment functions for each of the dedicated keys. Use LD 11 to program keys 16-26 on the i2002 Internet Telephone.

Note: If you attempt to configure anything other than the permitted response, the system generates an error code.

Table 1
i2002 Internet Telephone dedicated keys

Key Number	Feature	Comments
Key 17	TRN (transfer)	alternate: A03 (3-party conference)
Key 18	A06 (6-party conference)	
Key 19	CFW (call forward)	
Key 20	RGA (ring again)	
Key 21	PRK (call park)	
Key 22	RNP (ringing number pickup)	
Key 23	(reserved for speed dial)	
Key 24	PRS (private release)	
Key 25	CHG (charge account)	
Key 26	CPN (calling party number)	
Keys 27 - 31	reserved	

i2002 Internet Telephone components list

Table 2 lists the i2002 Internet Telephone package components.

Table 2
i2002 Internet Telephone package components (Part 1 of 2)

i2002 Internet Telephone, with North American power supply package, includes:	NTDU76AA
▪ Telephone handset ▪ i2002 Telephone footstand ▪ Telephone handset cord ▪ 7ft Ethernet cable ▪ Power transformer (117/120 VAC 50/60 Hz) ▪ i2002 Getting started card (English) ▪ i2002 Getting started card (French)	
i2002 Internet Telephone, without power supply package, includes:	NTDU76BA
▪ Telephone handset ▪ i2002 Telephone footstand ▪ Telephone handset cord ▪ 7ft Ethernet cable ▪ i2002 Getting started card (English) ▪ i2002 Getting started card (French)	
Telephone handset cord (Ethergray)	A0788682
8.8ft (2.7m) Telephone handset cord (Charcoal)	A0792037
12ft (3.7 m) Telephone handset cord (Charcoal)	A0855591
Telephone handset (Ethergray)	A0788874
Telephone handset (Charcoal)	A0758634
i2002 Telephone footstand	NTDU84AA
7ft. Ethernet cable category 5	A0648375
i2002/i2004 Power Adaptors	
Power transformer (117/120 VAC 50/60 Hz) (North America)	A0619627

Table 2
i2002 Internet Telephone package components (Part 2 of 2)

Power transformer 3 prong AC to AC, direct plug-in, 8W, 240 VAC, 50Hz to 16 VAC at 500 mA (Ireland and UK)	A0656598
Power transformer AC to AC, direct plug-in, 8W, 230 VAC, 50/60 Hz, to 16 VAC at 500 mA (Europe)	A0619635
Power transformer 2 prong wall plug direct plug-in AC to AC, 8W, 240 VAC, 50 Hz, to 16 VAC at 500 mA (Australia and New Zealand)	A0647042
Power transformer AC to AC, direct plug-in, 8W, 100 VAC, 50 Hz, to 16 VAC at 500 mA	A0828858

Before you begin

The following section provides a step-by-step guide through the i2002 Internet Telephone installation process. Before installing the i2002 Internet Telephone, complete the following pre-installation checklist.

Procedure 1 Pre-installation checklist

- 1 Ensure there is one i2002 Internet Telephone boxed package for each i2002 Internet Telephone being installed. The package contains:
 - i2002 Internet Telephone
 - 2.3m (7 foot) Ethernet cable, Category 5
 - Getting Started Guide
 - Telephone handset
 - Telephone handset cord
 - Telephone footstand
- 2 To install and configure an i2002 Internet Telephone, the host system must be installed with the Voice Gateway Media Card.
- 3 If you purchase a telephone that does not include a power supply, ensure that you have a power supply (local or closet) appropriate for the voltage in the designated area.

- 4 Understand the three configuration modes that you can choose from as you proceed through the installation of the i2002 Internet Telephone. The three configuration modes are:
 - Static IP address – see “Static IP address assignment” on page 23.
 - Dynamic Partial DHCP – see “Dynamic IP address assignment — Partial DHCP” on page 23.
 - Dynamic Full DHCP – see “Dynamic IP address assignment — Full DHCP” on page 24.
- 5 A DHCP server and DHCP relay agents, if required, must also be installed, configured, and running.

End of Procedure

i2002 Internet Telephone Startup Sequence

When an i2002 Internet Telephone is connected to the network, it needs to execute a startup sequence. The elements of the startup sequence include:

- obtaining the IP parameters
- finding a gateway server
- authenticating the user

See Table 3 for a summary of the IP parameters and how they are obtained.

Note: For all IP static assignments, your System Administrator provides the network information.

Table 3
i2002 Internet Telephone IP parameters

Parameter	Method of Acquisition
IP Address	Manually entered or automatically retrieved through Partial or Full DHCP.
Net Mask	Manually entered or automatically retrieved through Partial or Full DHCP.
Router Address	Manually entered or automatically retrieved through Partial or Full DHCP.
Connect Server (IP address, port, action and retry count — primary and secondary)	Manually entered or automatically retrieved through Full DHCP.
User ID (Node ID, Node Password and TN)	Manually entered for first-time configuration. Retrieved from local storage on subsequent power cycles. Provided by your System Administrator.

First-time i2002 Internet Telephone installation

During the first-time installation and depending on the type of installation used to configure the Internet Telephone, there are IP address parameters that you may have to enter. As well, you are prompted to enable or disable 802.1Q. For more information, see "802.1Q description" on page 123.

There are three configuration modes that you can choose from to obtain the IP parameters. Review the following sections for more information on the configuration mode that you are using.



Static IP address assignment

During the installation, the Internet Telephone parameters are entered manually using the Internet Telephone's keypad.

Your System Administrator provides the following information: IP address for the Internet Telephone, subnet mask, and the default gateway.

You must also enter the Connect Server parameters including: IP address, port number, action, and retry count.

Go to Procedure 2, "Installing an i2002 Internet Telephone for the first time" on page 24.



Dynamic IP address assignment — Partial DHCP

For a partial DHCP installation, you must provide, through the Internet Telephone's keypad, the Connect Server parameters including: IP address, port number, action, and retry count. Other parameters (Internet Telephone IP address, subnet mask and default gateway) are retrieved from the DHCP server.

The Internet Telephone password, node ID and TN must be entered manually from the keypad.

For more information about DHCP servers, see *IP Line: Description, Installation and Operation* (553-3001-204).

Go to Procedure 3, "Installing an i2002 Internet Telephone for the first time using DHCP" on page 29.

3

Dynamic IP address assignment — Full DHCP

For a full DHCP installation, all parameters (Internet Telephone IP address, subnet mask, default gateway, Connect Server IP address, port number, action and retry count) are retrieved from the DHCP server to recognize the i2002 Internet Telephone.

The Internet Telephone password, node ID and TN must be entered manually from the keypad.

For more information on how to set up DHCP servers for use with the Internet Telephones, refer to *IP Line: Description, Installation and Operation* (553-3001-204).

Go to Procedure 3, “Installing an i2002 Internet Telephone for the first time using DHCP” on page 29.

Procedure 2

Installing an i2002 Internet Telephone for the first time

- 1 Configure a virtual loop on the system using LD 97.

For more information, see *Software Input/Output: Administration* (553-3001-311).

- 2 Configure the i2002 Internet Telephone on the system using LD 11.

For more information, see *Software Input/Output: Administration* (553-3001-311).

- 3 Connect the i2002 Internet Telephone components:

- a. Connect one end of the handset cord to the handset jack on the back of the telephone identified with a handset icon.
- b. Connect the other end of the handset cord to the handset.

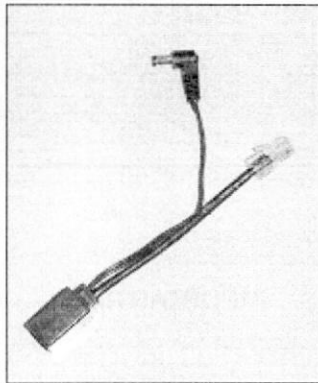
- 4 Power the i2002 Internet Telephone using either the Power over LAN Hub™ (closet power) or an AC power transformer (local power).

- a. If local power is used, plug the AC power transformer into the nearest power outlet. Ensure the correct AC power transformer is used for the country. Connect the power jack as shown in Figure 4. Be sure to

thread the cord around the retaining hook to provide strain relief for a secure power connection.

- b. If using the Power over LAN Hub™, a power splitter is required to split the power from the CAT-5 line cable (see Figure 3 and Figure 7 on page 52. Refer to the Power over LAN Hub™ User Guide included in the Power over LAN Hub™ package for more details on configuring power over LAN.

Figure 3
Power splitter



- c. Choose one of the following connections:

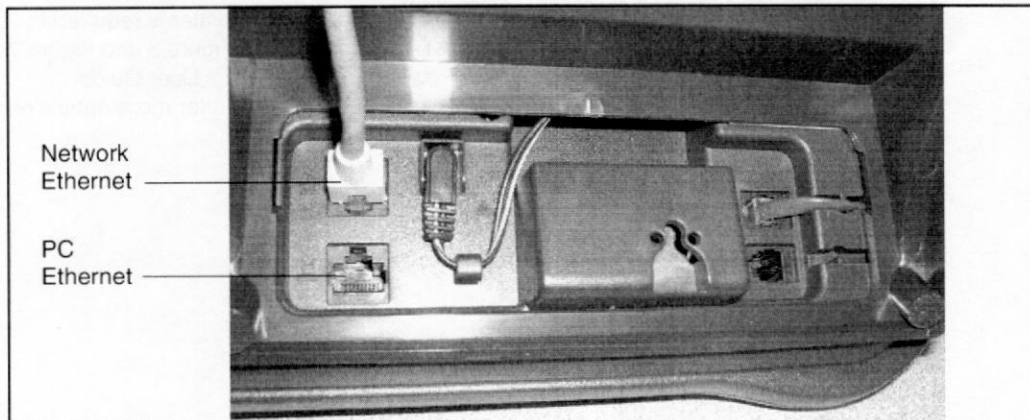
- i. For a telephone not sharing LAN access with a PC:

Connect one end of the CAT-5 line cable to the LAN ethernet jack located on the back of the telephone (identified with a LAN icon, see Figure 4). The other end of the CAT-5 line cable plugs into the IP network.

- ii. For a telephone sharing LAN access with a PC:

Connect one end of the CAT-5 line cable to the LAN ethernet jack located on the back of the telephone (identified with a LAN icon, see Figure 4) and the other end to the IP network. Insert a second CAT-5 line cable into the PC ethernet jack located on the back of the telephone (identified with a PC icon, see Figure 4) and the other end into the computer.

Figure 4
i2002 Ethernet port connections



IMPORTANT!

Timing information

There are only four seconds between plugging in the i2002's power transformer and the appearance of the Nortel Networks logo on the display. When you see the logo, you have one second to respond by pressing the four feature keys at the bottom of the display in sequence from left to right. If you miss the one second response time, the i2002 Internet Telephone attempts to locate the connect server. Wait until it is finished, and then begin the power up sequence again.

- 5 Reset the i2002 Internet Telephone by unplugging and replugging the power jack.
- 6 When the Nortel Networks logo appears on the display, immediately press the four feature keys at the bottom of the display in sequence from left to right.
- 7 At the prompt DHCP Yes/No?, select **No**.

- 8 Enter the following information provided by your System Administrator:

Screen prompt	Description
set IP	A valid i2002 Internet Telephone IP address.
net msk	A subnet mask.
def gw	The default gateway for the i2002 Internet Telephone on the LAN segment to which it is connected.

Note: The Internet Telephone can support a primary (S1) and secondary (S2) connect server. However, for Meridian 1 and CSE 1000 systems, the information entered for the primary connect server must be identical to the secondary connect server.

- 9 Enter the information for the primary Connect Server (S1) and the secondary Connect Server (S2):

Screen prompt	Description
S1 IP	The node IP address of the IP line node.
S1 Port	This is a fixed value: 4100
S1 action	This is a fixed value: 1
S1 retry	The number of times the Internet Telephone attempts to connect to the server. Enter 10.
S2 IP	Same as S1
S2 Port	Same as S1
S2 action	Same as S1
S2 retry	Same as S1

After the S1 and S2 server information is entered, the VLAN option appears on the display:

Screen prompt	Description
0-No	Disable 802.1Q and complete the configuration of the Internet Telephone. 0-No is the default value.
1-Yes	Enable the 802.1Q header.

- 10 If 802.1Q is *not* required, go to step 12, otherwise select 1-Yes to display the following VLAN ID:

Manual Cfg
VLAN: 1234

Note: The VLAN ID is entered as a decimal number. The VLAN ID is a 12-bit value between 0 and 4095.

- 11 Enter a valid value and press **OK**.

The Internet Telephone is configured with 802.1Q enabled, priority = 6, and the VLAN ID set to the entered value.

The i2002 Internet Telephone searches for the connect server. When the connection is complete, proceed with step 12.

- 12 Enter the following information provided by your System Administrator:

Screen prompt	Description
Password	Internet Telephone Installer Password You are not prompted to enter the Internet Telephone Installer Password if it has not been configured in your system.
Node	The node ID.
TN	The TN or VTN.

The i2002 Internet Telephone registers with the Terminal Proxy Server (TPS) and if needed, begins the firmware download. This takes several minutes. When complete, the i2002 Internet Telephone resets.

The current system date and time appear on the top line of the display when the configuration is complete. Self-labelling keys also appear.

- 13 Check for dial tone and the correct DN above the display.
- 14 Secure the telephone footstand to the base of the telephone. Use the angle adjustment grip on the top back of the telephone to adjust the position.
- 15 (Optional) Customize the Feature Keys as required. For more information, see "Configure programmable line (DN)/feature key labels" on page 117.

End of Procedure

Procedure 3**Installing an i2002 Internet Telephone for the first time using DHCP**

- 1 Complete steps 1–5 from Procedure 2 on page 24.
- 2 When the Nortel Networks logo appears on the display, immediately press the four feature keys at the bottom of the display in sequence from left to right.
- 3 At the prompt DHCP Yes/No?, select **Yes**.
- 4 Select Partial or Full DHCP.
 - a. If you select Full DHCP, then the following parameters are retrieved from the DHCP server:
 - A valid i2002 Internet Telephone IP address.
 - A subnet mask.
 - The default gateway for the i2002 Internet Telephone on the LAN segment to which it is connected.
 - The node IP address of the IP line node.
 - The S1 Action.
 - The retry count. This is the number of times the Internet Telephone attempts to connect to the server.

- b. If you select Partial DHCP, then you must enter the following parameters:

Screen prompt	Description
S1 IP	The node IP address of the IP line node.
S1 Port	This is a fixed value: 4100
S1 action	This is a fixed value: 1
S1 retry	The number of times the Internet Telephone attempts to connect to the server. Enter 10.
S2 IP	Same as S1
S2 Port	Same as S1
S2 action	Same as S1
S2 retry	Same as S1

Note: The Internet Telephone can support a primary (S1) and secondary (S2) connect server. However, for Meridian 1 and Succession CSE 1000 systems, the information entered for the primary connect server must be identical to the secondary connect server.

After the Partial or Full DHCP steps are completed, the VLAN option appears on the display.

- 5 Select either **1-Ma** or **2-Au** to enable 802.1Q from the DHCP Enabled - VLAN Options menu.

Screen prompt	Description
0-No	802.1Q remains off and initialization continues. 0-No is the default value. If this is selected, proceed to step 7 to continue the Internet Telephone configuration.
1-Ma	Enter a VLAN ID manually. If this is selected, proceed to step 6 to continue the 802.1Q configuration.
2-Au	Automatically enter a VLAN ID using DHCP. DHCP auto discovers the VLAN ID. No further steps are required to configure 802.1Q on the Internet Telephone. If this is selected, proceed to step 7 to continue the Internet Telephone configuration.

If **1-Ma** is selected, then the following VLAN ID displays:

Manual Cfg
VLAN: 1234

Note: The VLAN ID is entered as a decimal number. The VLAN ID is a 12-bit value between 0 and 4095.

- 6** Enter a valid value and press **OK**.

The Internet Telephone is configured with 802.1Q enabled, priority = 6, and the VLAN ID set to the entered value.

The i2002 Internet Telephone searches for the connect server. When the connection is complete, proceed to step 7.

- 7** Enter the following information provided by your System Administrator.

Screen prompt	Description
Password	Internet Telephone Installer Password You are not prompted to enter the Internet Telephone Installer Password if it has not been configured in your system.
Node	The node ID.
TN	The TN or VTN.

The i2002 Internet Telephone registers with the TPS and if needed, begins the firmware download. This takes several minutes. When complete, the i2002 Internet Telephone resets.

The current system date and time appear on the top line of the display when the configuration is complete. Self-labelling keys also appear.

- 8** Check for dial tone and the correct DN above the display.
- 9** Secure the telephone footstand to the base of the telephone. Use the angle adjustment grip on the top back of the telephone to adjust the position.
- 10** (Optional) Customize the Feature Keys as required. For more information, see "Configure programmable line (DN)/feature key labels" on page 117.

End of Procedure

i2002 Internet Telephone power cycle description

The power cycle is similar to the initial installation. The i2002 Internet Telephone saves its firmware, IP parameters, Node Number, and TN in memory. As the i2002 Internet Telephone proceeds through a start-up sequence, it does not need to:

- re-enter the IP parameters
- reacquire firmware or prompt the user for Node Number and TN

When the power is down on the i2002 Internet Telephone, LAN access is not available for the PC or other data devices connected to the Internet Telephone. Access is restored when power is restored to the i2002 Internet Telephone.

Reinstalling an i2002 Internet Telephone

You can reinstall an existing, previously-configured i2002 Internet Telephone on the same system. For example, the i2002 Internet Telephone can be assigned to a new user (new TN) or to an existing user who moved to a new subnet by changing the TN of the Internet Telephone.

Procedure 4

Changing the TN of an existing i2002 Internet Telephone

- 1 Repower the i2002 Internet Telephone.
- 2 If node password is not enabled:
 - a. Press **OK** when the node number displays.
A TN screen displays.
 - b. Select the **Clear** soft key to clear the existing TN.
A new parameters prompt displays.

Note: During the reboot sequence of a previously configured Internet Telephone, the i2002 Internet Telephone displays the existing node number for approximately 5 seconds.

- 3 If node password is enabled and is not NULL:
 - a. Press **OK** when node number displays.
A password screen displays.

- b. Enter correct password, and press **OK**.

A TN screen displays.

- c. Select the Clear soft key to clear the existing TN.

A new parameters prompt displays.

Note: During the reboot sequence of a previously configured Internet Telephone, the i2002 displays the existing node number for approximately 5 seconds.

- 4 If node password is enabled and NULL, choose one of the following:

- a. Disable password and complete step 2.

- b. Set password as non-NULL and complete step 3.

End of Procedure

Replacing an i2002 Internet Telephone

IMPORTANT!

Two telephones cannot share the same TN. You must remove the i2002 Internet Telephone that is currently using the TN.

Procedure 5

Replacing an i2002 Internet Telephone

- 1 Disconnect the i2002 Internet Telephone that you want to replace.
- 2 Follow Procedure 2 on page 24 (static IP assignment) or Procedure 3 on page 29 (dynamic IP assignment) to install and configure the i2002 Internet Telephone.
- 3 Enter the same TN and Node Number as the i2002 Internet Telephone you replaced. The system associates the new i2002 Internet Telephone with the existing TN.

End of Procedure

Removing an i2002 from service

Procedure 6

Removing an i2002 Internet Telephone from service

- 1 Disconnect the i2002 Internet Telephone from the network or turn off the power.

Note: The service to the PC is disconnected as well if the PC is connected to the Internet Telephone.

If the i2002 Internet Telephone was automatically configured, the DHCP lease expires and the IP address returns to the available pool.

- 2 In LD 11, OUT the TN.

End of Procedure

802.1Q description

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This section contains information on the following topics:

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Overview

The 802.1Q VLAN support is available for both i2002 and i2004 Internet Telephones and the i2050 Software phone (through the PC's operating system).

The 802.1Q VLAN support is configured from the user display interface of the i2002/i2004 Internet Telephones. Configure 802.1Q VLAN support when you initially configure an Internet Telephone.

802.1Q protocol standard

The 802.1Q IEEE protocol standard allows virtual LANs (VLANs) to be defined within a single LAN. This improves bandwidth management and limits the impact of broadcast and multicast messages. A higher level of security between segments in a network can also be achieved.

Currently customers must configure the VLAN and packet priority at the network switch port for each Internet Telephone. Supporting 802.1Q in the Internet Telephones simplifies this configuration and moves it to the end device. The network switching equipment must still be capable of recognizing and processing the 802.1Q header.

Only i2002 and the i2004 Internet Telephones and the i2050 Software Phone running on a PC configured with 802.1Q can generate the 802.1Q header. The switch ports for Voice Gateway Media Card TLAN ports must be configured as untagged ports so the header is removed.

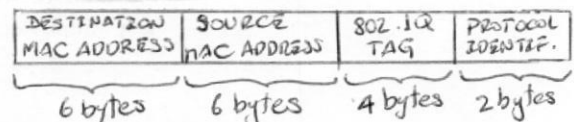
Note: 802.1Q functionality is supported only on the Internet Telephone. The IP Line application's IP stack does not provide 802.1Q support for the ITG-P or SMC.

802.1Q feature description

The p bits within the 802.1Q standard allow packet prioritization at Layer 2 improving network throughput for VoIP data.

The 802.1Q standard specifies a new format of Ethernet frame. A standard Ethernet frame contains:

- a header consisting of a six-byte destination MAC address
- a six-byte source MAC address
- a two-byte protocol identifier



Following the header is a data area.

The 802.1Q formatted frame is identical to a standard Ethernet frame, with the exception of the 4-byte 802.1Q tag that is inserted between the source MAC address and the protocol identifier. The first 16 bits of the 802.1Q tag

field is the Tag Protocol Identifier containing 8100 (hex), allowing the Ethernet interface to distinguish it from standard Ethernet frames. The last 16 bits of the 802.1Q tag contain the following information:

- a 3-bit Priority field (the 802.1p defined bits)
- a 1-bit Canonical Field Identifier (CFI)
- a 12-bit VLAN ID field

i2004 and i2002 Internet Telephone support

The i2002 and i2004 Internet Telephones support 802.1Q as follows:

- 802.1Q can be enabled or disabled at boot time using manual configuration or control downloaded from the TPS.
- If 802.1Q is disabled, standard Ethernet frames are transmitted.
- If 802.1Q is enabled, all frames transmitted by the Ethernet driver have the 802.1Q tag bytes inserted between the source MAC address and the protocol type field. The tag protocol identifier field contains 8100(hex) and the CFI bit is set to 0.
- When 802.1Q is enabled, the priority bits of all frames are set to 6 (octal) and the VLAN ID is set to 000(hex) by default. The GUI and TPS configured values override these values.
- The Internet Telephone's Ethernet driver receives any Ethernet frame destined for it, regardless of whether 802.1Q is enabled or whether the received frame is an 802.1Q tagged frame.

Note: The only exception is any 802.1Q tagged frame with the CFI=1. In this case the frame is discarded.

- The Internet Telephone's Ethernet driver strips the 802.1Q tag information from the frame prior to passing it on to the IP stack. Priority and VLAN information on received frames is not preserved and is ignored.

For more information on configuring 802.1Q on an i2002 Internet Telephone, see "First-time i2002 Internet Telephone installation" on page 23.

For more information on configuring 802.1Q on an i2004 Internet Telephone, see "First-time i2004 Internet Telephone installation" on page 50.

i2050 Software Telephone support

The i2050 software phone supports 802.1Q with Windows 2000. By default, when 802.1Q is enabled, the priority bits of all frames are set to 6 and the VLAN ID is set to 0 (a restriction of Windows 2000).

For more information, see the i2050 Software Phone section: "QoS tab" on page 106.

Three-Port Switch support

The i2004 Internet Telephone three-port switch does not interpret the 802.1Q header, but rather, allows the packets to pass through unmodified. Priority is achieved on a per port basis. The phone "port" traffic has higher priority over the Ethernet port to which the PC is connected.

An Internet Telephone can receive Broadcast frames from a PC's data VLAN. Any data network broadcast storm packets from the network are seen by the Internet Telephone. This type of traffic does not adversely affect the Internet Telephone.

VLAN IDs

The VLAN ID field can be specified on a “per interface” basis. There is only one network interface on the Internet Telephone, therefore, the VLAN ID field is a “global” setting. That is, all packets transmitted by the Internet Telephone have the same VLAN ID.

The VLAN ID is specified as follows:

- The default VLAN ID is 000 (hex).
- The VLAN ID can be specified in the manual configuration user interface or by the DHCP parameter when using the Automatic VLAN discovery using DHCP approach.

Automatic VLAN ID configuration

As part of the 802.1Q feature, there is an option to automatically discover the VLAN ID using DHCP. This process reduces the configuration steps since entering data manually (the VLAN ID) is not required.

When the Automatic VLAN Discovery using DHCP approach is used, and the Internet Telephone has been configured as such, the following steps are automatically taken to obtain the VLAN ID:

- 1 The i2002/i2004 does an initial DHCP Discovery Request in the default VLAN.
- 2 The DHCP server returns a DHCP Ack message with an IP address in the data VLAN and one or more voice VLAN IDs in the vendor-specific field.
- 3 The telephone reads and saves the voice VLAN IDs.
- 4 The telephone rejects the DHCP offer (accepts it but immediately gives up the lease).
- 5 The telephone reboots and sends a DHCP Discovery Request with the first VLAN ID from the saved list. This is repeated for each VLAN ID in the list until a response is received.

This works because the Layer 2 switch discards every DHCP Discovery Request it receives from the Internet Telephone if the VLAN ID does not match the VLAN IDs configured on the port. When the Internet Telephone sends a DHCP Discovery Request with the port's configured VLAN ID, the packet passes into the network and the DHCP server's Ack message is passed back.

When a DHCP Ack message is received, the Internet Telephone accepts the offer and saves the IP address and Node IP address.